What is claimed is:

1. A device for detecting a member of a specific binding pair in a sample comprising:

a substrate;

a variable charge density layer having a surface adjacent to the substrate and a surface remote from the substrate;

a first member of the specific binding pair on the variable charge density layer surface remote from the substrate, wherein the first member interacts with a second member of the specific binding pair present in a sample; and

the variable charge density layer having a charge carrier density that can be changed by the application of light and/or an electric field, so that a plasmon band is detected by a reflected light source impinging on the variable charge carrier density layer.

2. The device according to Claim 1, the plasmon band has a wave number between about 2,000 to about 20,000 cm^{-1}.

3. The device according to Claim 1, wherein the plasmon band has a wave number between about 2,000 and about 14,000 cm^{-1}.

4. The device according to Claim 1, wherein the substrate is transparent.

5. The device according to Claim 1, wherein the substrate is nontransparent.

6. The device according to Claim 1, wherein shining a second light source on the variable charge carrier density layer produces a modulation of a plasmon band measured by the reflected light source impinging upon the variable charge density layer.

7. The device according to Claim 1, wherein the variable charge density layer comprises a metal oxide.

8. The device according to Claim 1, wherein the variable charge density layer comprises a metal chalcogenide.

9. The device according to Claim 1, wherein the variable charge density layer comprises a non-degenerate semiconductor.

10. The device according to Claim 1, wherein the variable charge density layer comprises a degenerate semiconductor.

11. The device according to Claim 1, wherein the variable charge density layer comprises a conducting metal oxide or metal chalcogenide that is an infrared light reflector and transparent to visible light.

12. The device according to Claim 1, wherein the variable charge density layer comprises at least one of indium tin oxide, fluorine-doped tin oxide, iridium oxide, ruthenium oxide, cadmium oxide, yttrium oxide, scandium oxide, yttrium tin oxide, and scandium tin oxide.

13. The device according to Claim 1, wherein the first member is a monolayer on the surface of the variable charge density layer remote from the substrate.

14. The device according to Claim 1, wherein the reflected light source comprises an infrared polarized light source.

15. A device for detecting a member of a specific binding pair in a sample comprising:

a substrate;

a semiconductor layer having a plasmon band and a surface adjacent the substrate and a surface remote from the substrate; and

a first member of a specific binding pair on the surface of the semiconductor layer remote from the substrate, wherein the first member interacts with a second member of the specific binding pair present in a sample.

16. The device according to Claim 15, wherein the plasmon band has a wave number between about 2,000 to about 20,000 cm^{-1}.

17. The device according to Claim 15, wherein the plasmon band has a wave number between about 2,000 and about 14,000 cm^{-1}.

18. The device according to Claim 15, wherein the substrate is transparent.

19. The device according to Claim 15, wherein the substrate is nontransparent.

20. The device according to Claim 15, wherein the semiconductor layer comprises a metal oxide.

21. The device according to Claim 15, wherein the semiconductor layer comprises a degenerate semiconductor.

22. The device according to Claim 15, wherein the semiconductor layer comprises a non-degenerate semiconductor.

23. The device according to Claim 15, wherein the semiconductor layer comprises a conducting metal oxide or metal chalcogenide that is an infrared light reflector and transparent to visible light.

24. The device according to Claim 15, wherein the semiconductor layer comprises at least one of indium tin oxide, fluorine-doped tin oxide, iridium oxide, ruthenium oxide, cadmium oxide, yttrium oxide, scandium oxide, yttrium tin oxide, and scandium tin oxide.

25. The device according to Claim 15, wherein the first member of the specific binding pair is a monolayer on the surface of the semiconductor layer remote from the substrate.

26. The device according to Claim 15, wherein a reflected light source produces the plasmon band.

27. The device according to Claim 26, wherein shining a second light source on the semiconductor layer produces a modulation of a plasmon band measured by the reflected light source impinging upon the semiconductor layer.

28. The device according to Claim 15, wherein the semiconductor layer has a variable charge carrier density.

29. A system for detecting a member of a specific binding pair in a sample comprising:

a substrate;

a variable charge density layer layer having a surface adjacent the substrate and a surface remote from the substrate; and

a first member of the specific binding pair on the variable charge density layer surface remote from the substrate, wherein the first member interacts with a second member of the specific binding pair present in a sample;

a means for changing the variable charge density of the variable charge density layer for producing a plasmon band;;

a means for detecting the plasmon band from the variable charge density layer.

30. The system according to Claim 29, wherein the means for changing the variable charge density of the variable charge density layer comprises a generator configured to apply light.

31. The system according to Claim 29, wherein the means for changing the charge density of the variable charge density layer comprises a generator configured to apply an electric field.

32. The system according to Claim 29, wherein the means for changing the variable charge density comprises a reflected light source positioned to impinge on the variable charge density layer for producing a plasmon band.

33. The system according to Claim 30, wherein the means for detecting the plasmon band comprises a detector positioned to detect light reflected from the variable charge density layer.

34. The system according to Claim 29, wherein the plasmon band has a wave number between about 2,000 to about 20,000 cm^{-1}.

35. The system according to Claim 29, wherein the plasmon band has a wave number between about 2,000 and about 14,000 cm^{-1}.

36. The system according to Claim 29, wherein the substrate is transparent.

37. The system according to Claim 29, wherein the substrate is nontransparent.

38. The system according to Claim 29, wherein shining a second light source on the variable charge carrier density layer produces a modulation of a plasmon band measured by the reflected light source impinging upon the variable charge carrier density layer.

39. The system according to Claim 29, wherein the variable charge carrier density layer comprises a metal oxide.

40. The system according to Claim 29, wherein the variable charge carrier density layer comprises a metal chalcogenide.

41. The system according to Claim 29, wherein the variable charge carrier density layer comprises a degenerate semiconductor.

42. The system according to Claim 29, wherein the variable charge carrier density layer comprises a non-degenerate semiconductor.

43. The system according to Claim 29, wherein the variable charge carrier density layer comprises a conducting metal oxide or metal chalcogenide that is an infrared light reflector and transparent to visible light.

44. The system according to Claim 29, wherein the variable charge carrier density layer comprises at least one of indium tin oxide, fluorine-doped tin oxide, iridium oxide, ruthenium oxide, cadmium oxide, yttrium oxide, scandium oxide, yttrium tin oxide, and scandium tin oxide.

45. The system according to Claim 29, wherein the first member is a monolayer on the surface of the variable charge density layer remote from the substrate.

46. The system according to Claim 29, wherein the reflected light source comprises an infrared polarized light source.

47. The system according to Claim 29, wherein the means for detecting a change in plasmon band frequency comprises a means for detecting performed at a fixed angle.

48. A method for detecting a member of a specific binding pair in a sample comprising:
altering the charge carrier density of a variable charge density layer in response to a binding event.

49. The method of Claim 48, wherein altering the charge carrier density comprises altering the plasmon of the variable charge density layer.

50. The method of Claim 48, further comprising:
detecting the plasmon band of the variable charge density layer.

51. The method of Claim 48, further comprising:
detecting a change in the electromagnetic field of the variable charge density layer.

52. The method of Claim 48, further comprising:
applying light to the variable charge density layer to modulate the plasmon band of the variable charge density layer.

53. The method of Claim 48, further comprising:
applying an electric field to the variable charge density layer to modulate the plasmon band of the variable charge density layer.

54. The method of Claim 48, further comprising:
modulating the plasmon band of the variable charge density layer.

55. A method for detecting a member of a specific binding pair in a sample comprising:
detecting a first plasmon band measurement from a reflected light source on an optical layer having a first member of a specific binding pair attached thereto;
placing a sample in contact with the first member of the specific binding pair;
detecting a second plasmon band measurement from the reflected light source on the optical layer; and

if a plasmon frequency shift in the first and second plasmon band measurements is detected to indicate binding, determining that the sample comprises a second member of the specific binding pair.

56. The method according to Claim 55, wherein the first and second plasmon band measurements have wave numbers between about 2,000 to about 20,000 cm^{-1}.

57. The method according to Claim 55, wherein the first and second plasmon band measurements have wave numbers between about 2,000 to about 14,000 cm^{-1}.

58. The method according to Claim 55, further comprising:

shining a second light source on the optical layer during the detecting first and second plasmon band measurements steps, wherein the second light source modulates the first and second plasmon band measurements.

59. The method according to Claim 55, wherein the optical layer comprises a metal oxide.

60. The method according to Claim 55, wherein the optical layer comprises a metal chalcogenide.

61. The method according to Claim 55, wherein the optical layer comprises a semiconductor.

62. The method according to Claim 55, wherein the optical layer comprises a degenerate semiconductor.

63. The method according to Claim 55, wherein the optical layer comprises a non-degenerate semiconductor.

64. The method according to Claim 55, wherein the optical layer comprises a conducting metal oxide or metal chalcogenide that is an infrared light reflector and transparent to visible light.

65. The method according to Claim 55, wherein the optical layer comprises at least one of indium tin oxide, fluorine-doped tin oxide, iridium oxide, ruthenium oxide, cadmium oxide, yttrium oxide, scandium oxide, yttrium tin oxide, and scandium tin oxide.

66. The method according to Claim 55, wherein the interactive layer is a monolayer on the optical layer.

67. The method according to Claim 55, wherein the reflected light source is an infrared polarized light source.

68. The method according to Claim 55, wherein the detecting a change in plasmon band frequency is performed at a fixed angle.

69. A method for detecting a member of a specific binding pair in a sample comprising:

detecting a first plasmon band measurement from a reflected first light source on an optical layer having a first member of a specific binding pair attached thereto;

placing in contact with the first member of the specific binding pair;

detecting a second plasmon band measurement from the reflected first light source on the optical layer; and

shining a second light source on the optical layer to modulate the first and second plasmon band measurements.

70. The method of Claim 69, further comprising:

if a plasmon frequency shift in the first and second plasmon band measurements is detected to indicate binding, determining that the sample comprises a second member of the specific binding pair.

71. The method of Claim 69, wherein the first and second plasmon band measurements have wave numbers between about 2,000 to about 20,000 cm^{-1}.

72. The method of Claim 69, wherein the first and second plasmon band measurements have wave numbers between about 2,000 to about 14,000 cm^{-1}.

73. The method of Claim 69, wherein the optical layer comprises a metal oxide.

74. The method of Claim 69, wherein the optical layer comprises a metal chalcogenide.

75. The method of Claim 69, wherein the optical layer comprises a semiconductor.

76. The method of Claim 69, wherein the optical layer comprises a non-degenerate semiconductor.

77. The method of Claim 69, wherein the optical layer comprises a degenerate semiconductor.

78. The method of Claim 69, wherein the optical layer comprises a conducting metal oxide or metal chalcogenide that is an infrared light reflector and transparent to visible light.

79. The method of Claim 69, wherein the optical layer comprises at least one of indium tin oxide, fluorine-doped tin oxide, iridium oxide, ruthenium oxide, cadmium oxide, yttrium oxide, scandium oxide, yttrium tin oxide, and scandium tin oxide.

80. The method of Claim 69, wherein the interactive layer is a monolayer on the optical layer.

81. The method of Claim 69, wherein the reflected light source is an infrared polarized light source.